

**Creating climate smart rural
affordable housing – baseline
survey**



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Financial Sector Deepening Kenya (FSD Kenya) is an independent trust dedicated to the achievement of a financial system that delivers value for a green and inclusive digital economy while improving financial health and capability for women and micro and small enterprises (MSEs).

FSD Kenya works closely with the public sector, the financial services industry, and other partners to develop financial solutions that better address the real-world challenges that low-income households, micro and small enterprises, and underserved groups such as women and youth face.

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FSD Kenya is part of the FSD Network, a group of Financial Sector deepening programmes seeking to build diverse and inclusive financial systems across Africa, enable inclusive growth and enhance the financial resilience and sustainable livelihoods for all.



Gates Foundation



Author: [Dr Solomon Mwangi](#)

Contributor: [Samuel Karungai](#)

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Every effort has been made to verify the accuracy of the information contained in this report. All information was believed to be correct as of May 2025. Nevertheless, FSD Kenya cannot accept responsibility for the consequences of its use for other purposes or in other contexts.

1. Executive summary

This study was commissioned by FSD Kenya (Financial Sector Deepening Kenya) in 5 FSAs (Financial Sector Associations) under the support of K-Rep Fedha services in **October to December 2023**. FSAs are spread over 8 counties in Kenya namely Makueni, Kitui, Bomet, Busia, Vihiga, Kwale, Kakamega and Kilifi. The FSAs are member- based community organisations and provide different financial services to their members whose monthly incomes averages Ksh2,000/- to 20,000/-. There are 35 different FSAs spread across Kenya with a combined membership base of 350,000 members, and a cumulative balance sheet of approx. KShs 2.3 billion.

The objective of this study was to understand the housing conditions of FSA members and devise potential **housing and related housing loan products** that would help the FSAs members improve their current houses or built new improved ones, using locally appropriate, climate resilient, affordable construction technologies. The study covered all aspects of housing including water, sanitation, cooking stoves and lighting in addition to the housing unit itself.

The current construction technologies in use in all the 5FSAs are **Poles & Mud** and **Burnt Bricks**. The two technologies have an **adverse effect on the environment** as both involve cutting of the scarce trees. The quality of the burnt bricks observed was also poor, with up to 40% lost during production and low durability requiring plastering to enhance longevity. Water is a limited resource in the very remote areas, with little evidence of rainwater harvesting. Sanitation for human waste as expected is pit latrines, many in deplorable conditions where they exist, while firewood and charcoal are the main cooking fuel, further deteriorating the deforestation problem. As for lighting, solar lighting available through micro-loans from FSAs or solar product suppliers is on the right track and KPLC (Kenya Power & Lighting Company) has made great in roads interiorly.

The solution to improved and affordable housing is a long holistic process that must embrace new technologies and skills. It has to be jointly implemented by various stakeholders amongst them FSAs members, FSA staff, Builders and local artisans, Technical Training Institutions and both County and National Governments. The solutions proposed in this report includes both short and long-term. They will require training of local artisans, training of FSA shareholders and FSA staff, to enable the following as priorities:

1. Encouraging rainwater harvesting by availing loans for complete rainwater harvesting packages which includes tank, gutters and related installation accessories. Where water tanks have already been purchased but not fitted with the accessories, the rainwater harvesting is inefficient, and a smaller loan for the related accessories is required.
2. Availing a basic pit latrine and bathroom design that can be built easily in rural areas, using local materials.
3. Availing either training for the inbuilt firewood saving or ready-made stoves which are more environmentally friendly.
4. Introducing both **Stabilized Soil Blocks (SSB) and Sand Cement Blocks(SCB)** as future building technologies, incrementally replacing both Poles & Mud and Burnt Bricks. While these technologies have been around for many decades, the uptake has been low as a value chain approach has not been implemented. FSAs should consider investing in

the two building technologies (SSB & SCB) in form of equipment required for hire and the related technical training. They can do so by loaning enterprising FSA members with the necessary loan for a business/enterprise.) Building demonstration houses using these technologies in prominent locations is important for the FSA shareholders to appreciate the functionality and utility of these technologies and promote uptake.

5. Incrementally improving current houses by cementing the floors and plastering the walls which enhances hygiene and longevity by making the wall monolithic. Mud floors can be improved with plastering or embracing an oil-based technology like Earth Enable which is just entering Kenya after successful implementation in both Rwanda and Uganda. Many current houses require improved ventilation and lighting through fixing of bigger windows and doors.
6. The roll out of these technologies can be done through **introducing catalogues** with various house designs and related BOQs (Bill of Quantities) that can in future guide FSAs members choose appropriate house designs suitable to their needs and financial abilities. KFS and the FSAs will also need to undertake the financial product design and deployment for the various products. A simple one-page double sided A4 flier can be created and distributed to FSA members.

(5) above will be enabled through outcomes of the training and customer awareness in (2) (3) and (4) above.

All the above proposed solutions should be adopted and implemented simultaneously.

It is important to begin with a pilot of these housing solutions in a few FSAs and use the learnings from this pilot to expand to other areas. The demonstration houses using SSB (Stabilized Soil Blocks) and/or SCB (Sand Cement Blocks) depending on whether one or both are suitable for each area, should be built in a strategic public location, such as a marketplace or on the FSAs office compound where the land is adequate.

The demo house should have all other appropriate technologies such as solar lighting (which is already prevalent), improved kitchen with energy saving stove, water harvesting technologies and an improved pit latrine and bathroom. The construction of the demo house would serve also as a training ground for rural artisans, in all aspects of the new technologies and good building practices. The demo house will then serve as a launching pad for further dissemination and rolling out of the appropriate building technologies solutions.

As a starting point, these solutions can be introduced in 2 of the 5FSAs, potentially Kathonzi (Makueni county) and Kakeani (Kitui county) as they are closer to Nairobi and have membership incomes of Kshs 9,000/- per month on average. There are 24 FSAs in these 2 counties with a combined membership of over 200,000 people, therefore any successful pilot will be able to be scaled more easily and sustainably in these regions with support from KFS and the FSAs.

It will require approximately 3.3 million Kenya shillings to launch such a training program in every FSA. The costs are detailed in Table 1 of Section 5 and will enable the training of selected artisans, purchase of relevant equipment that the FSA can keep for hire, and building of a complete demonstration house with a pit latrine and shower. This is a small price to pay in the long-term for transforming life's, availing new livelihood opportunities and contributing to the saving of trees and conservation of the environment. This covers the training, equipment and materials cost only, no additional costs that may be incurred by the FSA staff or for product development.

Donor funds can be raised to finance this project in as a way of introducing new technologies which will not only improve rural houses but create sustainable employment in the construction industry.

2. Background information and the study objectives

Background to KFS and FSA

K-Rep Fedha Services (KFS) is registered under the Companies Act as a Limited liability Company, was established by K-Rep development Agency (KDA) in 2005 as a specialist FSA Management Company to provide management services and oversight to the Financial Sector Associations (FSAs) and promote financial inclusion and poverty eradication in the arid and semi-arid parts of the country.

Financial Services Associations (FSAs) are rural membership based financial institutions offering localized financial services to their members through pooling together of the members funds together. The basic FSA model is similar in many respects to other types of decentralised financial institutions; however, the common bond of the members is their physical location and that the members get interest rebate at the end of the year out of any monies made from the provision of the financial services to their members.

KFS in consultation with the governance committees employs and deploys managers to the FSAs who are charged with the day-to-day management of the FSA operations. Management capacity is spread across the network, with KFS head office providing technical backstopping. In addition to providing management services and oversight KFS has also been involved in outreach, promotion and establishment of additional FSAs.

The FSAs provides various financial services to its members in form of; savings, deposits and money transfers, Loans and capacity building to the members. The FSAs are member owned community- based organisations. They are all located in arid and semi-arid rural settings, reaching out to thousands of members, at the bottom of the financial pyramid, who otherwise may not access financial services provided by regular commercial banks and other financial institutions.

FSD Kenya (Financial Sector Deepening Kenya) has supported the sustainability of KFS over man years and sought to explore the feasibility to create affordable housing solutions for members of FSAs (Financial Sector Services) under support and network of KFS.



Objectives and scope of the housing study

The objectives of this study were to:

- A. Understand the current housing conditions and preferences of the FSAs members.
- B. Inform potential feasibility of designing housing products for the FSAs members income segment, using FSAs financial infrastructure and processes.

The study was undertaken in 5 selected FSAs namely; Kathonzweni in Makueni County, Kakeani in Kitui County, Malava in Kakamega County, Bamba and Matanomanne both in Kilifi Counties.

The scope of the study involved:

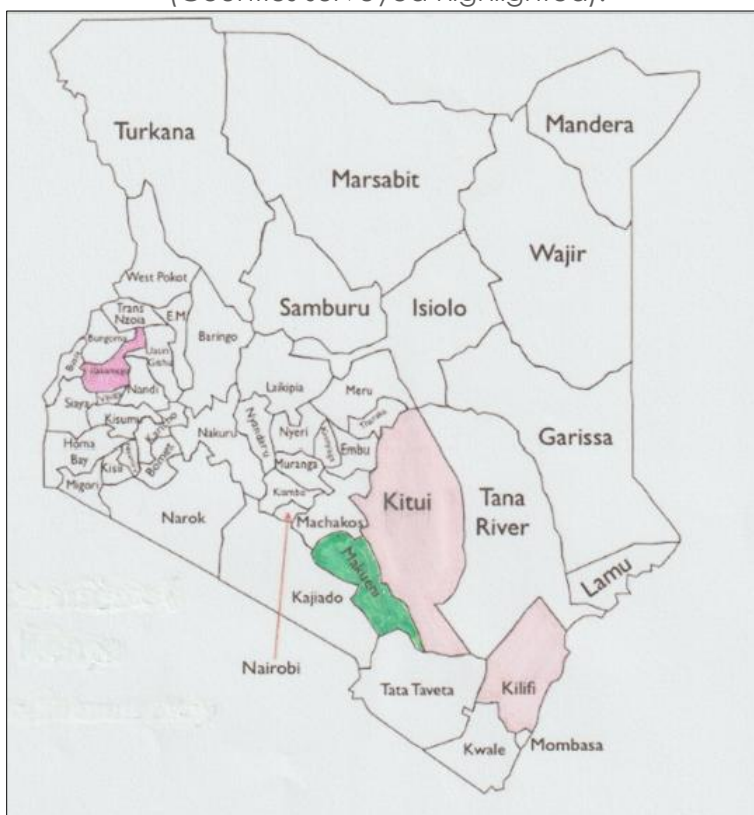
1. Understanding the various financial services and products currently offered by the FSAs to their members.
2. Designing different questionnaires for information gathering from different players who included FSAs members (the households and potential borrowers of housing products), local builders, building materials suppliers and manufactures.
3. Visiting the 5FSAs to gather information from all the key players through filling of the questionnaires, and interviews.
4. Compiling and submitting a report based on findings and conclusions reached after the data analysis.



The geographical area covered by study

The field survey covered all the selected 5 FSAs supported by KFS, which were visited by the consultant as highlighted in the map below.

Map of Kenya Counties.
(Counties surveyed highlighted).



Kathonzweni and Kakeani FSAs though in two different counties have many similarities in terms of climate, geographical features, soils and terrains, and so is Bamba and Matanomanne in Kilifi Counties. In this regard, findings and recommendations proposed for both Kathonzweni and Kakeani are similar, and so are the ones for both Bamba and Matanomanne FSAs. Only Malava FSA in this context was in its own category of a different climatic and geographical zone.

Membership of the 5 FSAs

The membership of the 5 FSAs at the time of the analysis and the financial services provided by each are summarized in the table below.

Membership Details	Kathonzweni	Kakeani	Malava	Bamba	Matanomanne
Female	6,823	11,200	7,620	6,954	8,000
Male	1,577	2,800	5,044	2,880	3,000
Total	8,400	14,000	12,664	9,834	11,000
Monthly income (Ksh).	9,000/-	9,000/-	20,000/-	9,000/-	2,000/-



Monthly incomes were advised by the local FSA staff as the consultant could not determine this. Malava has the highest monthly income of Kshs. 20,000/-, while Kathonzweni, Kakeani and Bamba incomes were around KShs 9,000/- and Matanomanne was the lowest at KShs 2,000/-.

The economic activities in all the FSAs were largely agricultural, for subsistence or trade, with limited other business enterprises.

Survey participants in each FSA

The table below summarises the number of participants who filled the different questionnaires, visited and interviewed during the survey:

No	Participants	Kathonzweni	Kakeani	Malava	Bamba	Matanomanne	Totals
1	Homeowners Questionnaires administered at FSAs group meetings.	36	98	46	118	84	382
2	Homeowners Visited.	12	15	20	15	10	72
3	Builders interviewed.	6	7	7	33	6	59
4	Building Materials Vendors interviewed.	5	1	3	3	3	15
5	Building Materials Manufacturers.	2	0	4	1	1	8

Footnotes: Building materials manufacturers includes metal doors and windows manufacturers, bricks and concrete block makers. Building materials vendors includes timber merchants, hardware shops, sand & gravel suppliers and solar electrical suppliers.

Products offered by the FSAs

The FSAs were offering the loan products listed below:

- ✓ Biashara (business) loans
- ✓ Maendeleo (development) loans
- ✓ Masomo (school fees) loans
- ✓ Emergency loans
- ✓ Asset loans
- ✓ Kilimo (Agriculture) loans
- ✓ Savings & money transfers
- ✓ Finance management

The tenor of these loans is a maximum of 36 months, interest rate of 1.5%, processing fee of 1% and an insurance fee of 0.06%. FSAs operate similar to a SACCO. Borrowers must be members of the FSA. The loan amount is dependent on the share capital, up to a maximum of 4 times a member's share capital. For asset financing, the asset can become part of the



collateral of that particular loan. Average loan size is 15,000/- though some borrowers have much bigger loans based on their capacity of up to KShs 1 million.

From discussions with KFS and FSA staff, the housing products would need to have a variable tenor depending on the loan amount, ranging from 2 years to a maximum of 5 years.



3. Findings of the housing conditions and building construction

The building construction analysis focused on construction materials and technologies used in the construction of the basic structure (walls & roof), as that is what constitutes the main house. Other building components such as cemented floors, plastered walls and provision of electrical and piped water services are undertaken progressively, dependent on the family's financial ability.

Construction technologies currently in use

Poles and Mud (P&M) and Burnt Bricks were the two main walling technologies in use by the majority of the FSAs members visited.

Burnt Bricks were predominant in both Kathonziweni and Kakeani (Makueni & Kitui) counties. Unfired or sun-dried bricks were the other alternative for walls construction for temporary or semi-permanent construction. The quality of the burnt bricks was poor, with some bricks eroding over the years necessitating plastering of the walls for protection. Losses of up to 40% of bricks produced was observed during the production process through breakages. In Malava FSA, the predominant walling material was P&M, improved with plastering using special clay sourced from specific and few localities. Those who could afford plastered their walls with cement/sand mortar. Burnt bricks though of poor quality were also used in a few homesteads.

In both Bamba and Matanomanne, P&M was observed to be the predominant walling material used for walls construction. There were a few houses built with unfired bricks. A few more houses were also built with locally made sand/cement blocks, an appropriate technology that requires full exploitation as good sand for construction is readily available to almost every homestead.










Other walling materials used but imported from outside the FSAs were machine cut stones from Thika used in Kakeani, Kathonziweni and Malava. In Bamba and Matanomanne, coral machine cut stones were also used for permanent construction though delivered from Kilifi town, a long distance to the construction sites. None of the visited FSA members had used either of the stones, which are generally a reserve for those with the financial ability. The main roofing material in all FSAs was iron sheets (mabati gauge 30 or 32) with a few houses roofed with grass (Malava) and makuti (Bamba & Matanomanne).

A housing priority analysis of whether the households would prioritise housing improvements over other needs like food, business, education etc was not undertaken in this scope. However, in every FSA, majority of the members interviewed expressed their wish of improving their current houses by any of the following:

1. Plastering the walls using cement/sand plaster
2. Improving the floor with a cemented floor
3. Building a new house for those which were beyond improvements or refurbishment. (A few poorly constructed buildings had collapsed during the long rains)



The table below highlights the walling technologies in use and the aspired improvements of the homeowners.

No	FSA	Technology	Current Houses	Aspired Houses
1	Kathonzweni & Kakeani FSAs	 Kiln for burning bricks.	 Burnt Bricks Construction.	 Improved Plastered Brick House.
2	Malava FSA	 P&M (Poles & mud) technology.	 P&M house improved with local clay plastering.	 P&M house improved with cement/sand plastering.
3	Bamba & Matanomanne	 Poles structure before infilling with mud.	 P&M house before plastering.	 Improved P&M house with cement/sand plastering.

Foot note

Construction technologies currently in use in both Kathonzweni & Kakeani are similar, and so are the ones used both in Bamba and Matanomanne FSAs. The situation in Malava is not very different, only that both burnt bricks, and poles and mud technologies are in use.

Water and sanitation








Water featured as a major concern as piped water remains a dream to many. Despite the long distances covered in fetching water, rain water harvesting has not been embraced as a source or solution to water shortage, either due to ignorance or lack of finance.

The main sources of water ranged from earth dams, wells and boreholes. Rivers as a source for water only featured in Malava and piped water in a few homesteads across the 5FSAs. The small earth dams popularly known as silangas are not featured as alternative sources of water in this report as they require mechanical excavators, on sloped sites for run-off rainwater collection, ideal for small scale irrigation and community water supply.

Pit latrines as would be expected featured as the main means of human waste disposal. This is well embraced everywhere other than a few areas in Bamba and Matanomanne. The main issue with pit latrines was one of a clean and safe slab for pit cover with majority using poles and mud which are not only dangerous but unhygienic. In a few homes, the pit latrine served both as a bath/shower room.



The table below depicts the water and sanitation scenario in the 5FSAs.

Dams	Piped	Boreholes/ Wells	Rainwater harvesting	Pit Latrines	Bath/Shower Rooms	Bath / shower rooms
						
In use in 4 FSAs with an exception of Malava FSA.	Featured in a few homes.	Community & privately owned Boreholes featured in Kathonzweni & Kakeani with wells only in Malava.	This featured in only a few homes. Some FSAs has plastic water tanks as one of their loan products but the necessary accessories of gutters, fascia boards etc have not been adopted.	Most pit latrine have mud floors.	Bath/shower rooms were mostly built with temporally materials, such as makuti (coconut) leaves.	Another example of temporary bathrooms

Cooking

The main cooking fuel in all the FSAs was firewood, using the traditional 3-stones as cooking stoves. There was very limited adoption of either firewood or charcoal improved, energy saving stoves. This limited adoption was attributed to:

1. Charcoal being an expensive cooking fuel to many.
2. Available stand-alone improved charcoal cooking stoves were described as small and inadequate to cook for big families. There is a need to see if bigger cookstoves are being made by stand-alone producers.
3. Improved firewood cooking stoves requires special expertise to build, a skill not available with the local artisans. Of note is the improved firewood stoves that can be made. These cookstoves can allow for multiple pots and pans to be heated at the same time. While the stove itself is made from burnt bricks, the longer-term environmental impact of reduced firewood for cooking is enormous.

The 3-traditional stove	Improved firewood stove	Improved charcoal stove
		



Lighting

In all the 5FSAs, lighting was well taken care of by either the solar companies that are providing affordable solar lighting loan packages and KPLC which has penetrated deeply in the villages. FSAs also have a solar lighting product available to its members. Very few homes reported the use of hurricane lamps and kerosine as a means for lighting.

Lighting from KPLC.	Solar packages available on higher purchase.	Other solar lighting.
		



4. Proposed alternative & appropriate housing improvements

Proposed alternative walling technologies

The need to replace current building construction technologies of burnt bricks and poles and mud with improved ones is very clear from the increasing aridity in the regions, and increased deforestation.

Both Soil Stabilised blocks (SSBs) and Sand Cement Blocks (SCBs) are greener and locally suitable technologies for these regions and are explained below.

Soil stabilised blocks (SSB)

SSBs also known as compressed earth blocks, are building (walling) blocks made from a mixture of soil and approximately 6-10% cement stabilizer. Cement is used to improve the soil strength and make the blocks water resistance. SSB is a better and cheaper alternative to burning of bricks as it preserves cutting of trees and saves on carbon emission.



SSBs are also economically viable as they are made using soils dug from foundation trenches or pit latrines. A manual block compressing machine which can be purchased for approximately KShs 120,000/= is used to compress the SSB's, resulting in a solid, dense and water resistance building block. 1 bag of cement produces on average 90 blocks (290x140x120mm) equivalent to 4M² of walling.

SCB (Sand Cement Blocks)

SCB are concrete blocks made from sand with approximately 12% cement as the stabilizer and binding agent. One (1) bag of cement on average produces 25 blocks (390x200x150mm) equivalent to 2M² of walling.

A simple hand mould which can be purchased for approximately KShs 15,000/= is used to produce blocks and can be moved from one site to the next making it a very versatile technology where sand is in plenty.

The key success to quality production of SCB is in mixing the ingredients and curing of the blocks.

	Soil Stabilised blocks	Sand Cement blocks
Equipment	 <p>Compressing machine costs approx. 120,000/=. Needs to be transported eg with a donkey cart.</p>	 <p>Hand mould costs approx. KShs 15,000/=. Easier to transport.</p>
Raw materials	Soil that is dug up from the site for the foundation and cement. Typically needs less cement than SCB.	Sand that is readily available in many of the FSA areas and cement
Technical capacity	Needs an understanding of what ratios of soils need to be mixed depending on the content of the soil	Lower technical requirement
Potential for use	Buildings made from SSB look more sophisticated and may draw more demand. As soil is excavated anyway for the foundation and it utilised in the block making, it can be economically cheaper.	Sand may have to be transported within short distances to some homesteads.

The rationale/justification of the proposed alternative walling technologies is based on:

1. The cost analysis tabulated below shows that SSBs and SCBs are actually cheaper than burnt bricks and poles and mud when costed comprehensively.
2. Maximization of locally available raw materials mainly soils and sand.
3. The environmental damage caused especially by cutting of trees used for firing bricks or for poles & mud construction.

For these reasons, training local artisans and demand on these technologies, and making the equipment available for hire through the FSAs is an important value chain approach for enabling housing outcomes.






Cross comparison of all the various walling construction costs analysis

In determining the most affordable and cost-effective construction technologies, a BOQ (*bill of quantities*) using different walling technologies based on a house with a floor area of 48M², comprising of 2-bedrooms and a living room has been used.

The cost analysis is based on the materials and technologies found in use and potential appropriate & affordable ones in the 5 FSAs. Detailed BOQ's using different technologies is available separately in an excel format.

The summary in the tabulation below summarises the cost of a complete house in the 5FSAs using different technologies.

Costs of current technologies across FSAs plus alternative more appropriate technologies. The houses have a height of 2.4 metres to the ceiling.

Simple 3 room (living room plus 2 bedrooms) house plan of 12 metre length and 4 m width costed out for each FSA										
House Plan & FSA										
House Plan & FSA	Poles & Mud		Burnt Bricks		Stabilized Soil Blocks		Sand/Cement Blocks		Machine cut stones	
3-Roomed House, L12M x W4M										
FSA	Cost/House	Cost/M ²	Cost/House	Cost/M ²	Cost/House	Cost/M ²	Cost/House	Cost/M ²	Cost/House	Cost/M ²
Kathonzweni& Kakeani	N/A	N/A	685,206/-	14,275/-	653,549/-	13,616/-	625,199/-	13,025/-	704,646/-	14,680/-
Malava	471,770/-	9,828/-	607,365/-	12,653/-	591,624/-	12,325/-	619,299/-	12,902/-	772,929/-	16,102
Bamba	512,136/-	10,699/-	N/A	N/A	639,319/-	13,319/-	610,969/-	12,728/-	726,597/-	15,137/-
Matanomanne	542,497/-	11,302/-	N/A	N/A	644,220/-	13,421/-	664,470/-	13,843/-	749,385/-	15,616/-

The table above shows the cost of greener technologies like SSB and SCB are 3-4% cheaper than burnt bricks and approximately 15% more expensive than poles and mud construction. As the cost of building a full 3-roomed ideal house is prohibitive to the FSA members, the cost of 1 room



using the favoured 2 greener technologies in the agreed pilot areas of Kathonzweni and Kakeani is shown below. The costs of these technologies are same in both these FSAs due to their similarities.

The technologies proposed below are not necessarily new in some regions, but rather unknown due to lack of information, promotion, skills and technology accessibilities. They provide excellent opportunities for new enterprises if introduced and promoted through the right self-selected, driven, ambitious entrepreneurs.

A costing for a 1-bedroom stand-alone unit for the two best technologies in terms of climate resilience and locally available materials in Kathonzweni and Kakeani has been developed. This is summarised below. The per square meter cost (cost/M2) goes up significantly for a 1 room versus a 3 room and the reasons are detailed in the comparison BOQs in the attached excel. The one roof cost is almost half of the 3-room cost (not 33% as if it were a prorata reduction). This is because the cost of the foundation, floor slab, roof, ring beam etc for a one room are approximately half the cost of a 3-room structure.

Estimated cost of 1-room 4Mx4M (16M2) Using the either Sand/Cement Blocks or Stabilized Soil Blocks And comparison with 3 room 12 M x 4 M (48M2) using same technologies					
No	FSA Note this picture is not representative of 1 room	Stabilized Soil Blocks		Sand/Cement Blocks	
		Cost/Room	Cost/M2	Cost/Room	Cost/M2
1 room	Kathonzweni & Kakeani	312,971/-	19,561/-	302,846/-	18,928/-
3 room	Kathonzweni & Kakeani	653,549/-	13,616/-	625,199/-	13,025/-

Proposed cooking, water and sanitation improved technologies










The tabulation below highlights the current cooking, water and sanitation technologies and proposed potential solutions. The proposals are as follows:

1. For cooking stoves, improved firewood cooking stoves built from burnt bricks already exist. The challenge is availability of skilled masons who can built them in rural areas. This would require some investment in training local masons who could then be engaged by the homeowners with guidance from FSAs to build them the improved stove in their current kitchens.
2. While FSAs are providing loans to members to purchase plastic water tanks for rain water harvesting, most of the tanks are ineffectively utilized as they lack gutters for water collection, with all the rains going into waste. The remedy to this problem is including a package of gutters and other accessories on the water tank loan package for effective rainwater harvesting. A menu of various rain water harvesting packages including the accessories for different water tank sizes is provided in Annex 1 of this report.



3. Pit latrine has three major challenges:



- I. Pit covers are currently made from poles and mud in most of the homestead. These are hard to maintain clean and fould free and have the danger of collapsing should the supporting poles rot.
- II. The second challenge in some regions especially with sandy soils (Bamba & Matanomanne) is collapsing pits which requires pit lining. Pit lining is expensively done using stones. Alternative solutions are therefore required which could include corrugated sheet metal or plastic liners.
- III. The last challenge is the pit latrine/bath room structure, which were built from poor materials such as coconut or banana leaves.

No	Cooking	Rainwater Harvesting	Pit Latrine
1	 <p data-bbox="404 873 708 905">What is currently in use.</p>	 <p data-bbox="802 888 1159 978">Poorly installed tank with no good gutters for water harvesting.</p>	 <p data-bbox="1221 888 1508 947">Current pit latrine slab covers.</p>
2	 <p data-bbox="367 1188 745 1247">Proposed improved firewood stove – newly built</p>	 <p data-bbox="810 1173 1151 1232">Same problem. No gutters and poorly installed tank.</p>	 <p data-bbox="1232 1197 1498 1228">Proposed pit covers.</p>
3	 <p data-bbox="375 1482 740 1539">A improved cookstove after use</p>	 <p data-bbox="789 1430 1172 1493">A properly installed rain water harvesting solution</p>	 <p data-bbox="1216 1430 1516 1493">A properly constructed slab for a pit latrine</p>



Incremental improvements of floors, walls, ventilations

The trained artisans will have the knowledge to support households to incrementally improve their floors, walls and enhance ventilation in their current homes. The cost of these improvements will depend on the scope of improvements and can be incrementally undertaken to fit with the household's affordability.

<p>1</p>	<p>Improving existing houses by</p> <ol style="list-style-type: none"> a. Plastering the walls and b. Cementing the floors or improving mud floors with oil-based technologies promoted by Earth Enable. <p>Earth Enable is a new affordable and appropriate floor technology, that improves mud with oil, a technology well-proven and widely adopted in Rwanda and Uganda promoted by Earth Enable (https://earthenable.org/) and is just entering Kenya in Western Kenya.</p>	
<p>2</p>	<p>Improving existing houses lighting and ventilation with Metal Doors & Windows Packages.</p>	



5. Summary of recommendations

The tabulation below summarizes major findings and recommendations on potential new housing products, that should result also in new business opportunities and employment creation.

No	Identified need	Proposed solution / Action Plan	Estimated financial cost
1	<p>Water. Access to clean and safe drinking water remains a major problem to many rural homes.</p>	<ul style="list-style-type: none"> Educate FSAs members on the benefits of rain water harvesting. Provide complete loan packages for rainwater harvesting as costed below. Giving out complete Rainwater Harvesting Loan Packages inclusive of tanks, gutters and required accessories. Lobby governments at both national and county government level to introduce policies that encourage rain water harvesting on every house . 	<ul style="list-style-type: none"> KShs 40,000/- for 5,000 litre tank.
2	<p>Pit Latrines and showers. Majority of the homesteads have poor pit latrines and bathrooms, and some none.</p>	<ul style="list-style-type: none"> There is need to develop a basic pit latrine design and shower area. Availing hygienic technologies for both pit latrine & bathrooms for floor slabs and super structures. Include in training, demonstration phase and catalogue. 	<ul style="list-style-type: none"> KShs 60,000/= for dual pit latrine and shower room
3	<p>Kitchens & Improved Firewood Stoves. Kitchens in rural settings are often a “Stand alone” building, separate from the main house. Most of them are poorly built, often as an afterthought and temporary “make shift” buildings.</p>	<ul style="list-style-type: none"> There is need to design a modified rural kitchen with an improved fuel saving (<i>firewood</i>) stove and a washing area for utensils. Such a kitchen design can also be part of the main building that will be built incrementally over time. The “stand-alone” kitchen to be part of the houses catalogue proposed. Rural artisans to be trained on how to build the improved fuel saving stoves. 	<ul style="list-style-type: none"> Improved cooking stove estimated at KShs 15,000/=
4a	<p>House Plans & BOQ.</p>	<ul style="list-style-type: none"> Develop basic housing plans catalogues with the aspired 	<ul style="list-style-type: none"> Engage a consultant to

	Homeowners have no access to basic housing designs suitable for their climatic conditions, local building materials and estimated costs. For instance, many houses in Bamba and Matanomanne have no windows leaving the rooms dark and unventilated.	<p>members designs, climate responsive with the corresponding bill of quantities for homeowners to choose from.</p> <ul style="list-style-type: none"> The houses should be designed in a way that allows progressive expansion and development. 	design and develop catalogues featuring various house designs for the different FSAs with FSAs members inputs.
4b	<p>Alternative Technologies. There is need to replace burnt bricks, poles and mud construction technologies due to their long-term effect on the environment.</p>	<ul style="list-style-type: none"> Introduce alternative and appropriate building technologies specifically SSBs (<i>Stabilized Soil Blocks</i>) and SCB (<i>Sand & Cement Blocks</i>) in all the 5FSAs. These two are environmentally friendly but cost effective. Introduce the two technologies by building of demo houses in 2-4 FSAs to serve as a pilot before rolling out across more FSAs. 	<ul style="list-style-type: none"> Estimate for 1 room house including labour is KShs 300-315k with SSB and SCB in Kathonzweni and Kakeani. Estimate for a 3-room house including labour KShs 615k and 630k with SSB and SCB in Kathonzweni and Kakeani.
4c	<p>Skilled Construction Workers. Many rural construction workers have no formal training and have learnt their construction skills informally onsite. They lack the finesses and theoretical understanding on essential good building practices that ensures sturdy, strong and permanent buildings.</p>	<ul style="list-style-type: none"> FSAs and local TVETs (<i>Technical & Vocation Education Training</i>) can seek ways for providing short-term skills upgrading training for rural artisans. This will be a requirement when FSAs starts providing loans for housing products, which must be constructed by competent builders. Use the construction of the proposed demo home using technologies proposed as a training ground for skills upgrading for selected rural artisans. Engage TVET's in such training programs. 	<ul style="list-style-type: none"> Training budget developed with KFS and FSAs. This is likely to continue to be subsidised for roll out across various FSAs
5	<p>Improve current housing which currently have poor flooring, ventilation etc</p>	<ul style="list-style-type: none"> From above, artisans will be trained to undertake incremental improvements to existing housing – eg. how to improve floors, ventilation etc 	<ul style="list-style-type: none"> Smaller loans for incremental improvements can be designed to improve flooring,



			walling, ventilation etc. The loans can range from KShs 20,000/= upwards
6	<p>Financial product development Appropriately sized loan products are required for each of the above house improvements.</p>	<ul style="list-style-type: none"> • KFS, FSA management and loan officers and FSD to co-design loan products. 	<ul style="list-style-type: none"> • From current projections, a loan pool of approximately KShs 5 million in each of the two pilot FSAs should be sufficient for the pilot period.
7	<p>Lighting. KPLC and solar lighting companies such as Delight, Sun king and Solar Panda have made big in loads interiorly, in reaching out to rural homes.</p>	<ul style="list-style-type: none"> • This is currently taken care of by the existing solar companies evident even in the remotest homes. • Continue promoting the adoption of solar lighting – include in fully complete demonstration houses for more customer awareness and uptake 	<ul style="list-style-type: none"> • No further action required as solar companies and FSAs already provide financing solutions and there is good uptake



Proposal for introducing, training and rolling out appropriate building technologies in FSAs rural settings.

Improving and building better houses for FSAs members is a long-term journey as other than the cost implication, it will involve changing traditional ways of construction and embracing new environmentally friendly technologies, which requires new construction skills, educative and awareness programs. Some of the loan products will be in form of services, requiring skills training and upgrading of local builders.

There are however immediate loan products FSAs could consider introducing in some regions as the first step towards improved affordable housing solutions to their members. The table below summarizes such products and possible ways of implementing them.

This proposal is aimed at introducing and rolling out Appropriate Building Technologies in rural settings through the FSAs program, providing FSAs members with quality houses using technologies that are environmentally friendly with low-carbon emissions, replacing the commonly used Burnt Bricks, Poles and Mud construction that cause a lot of deforestation. The two main appropriate building technologies recommended for introduction are SSB (*Stabilized Soil Blocks*) and SCB (*Sand Cement Blocks*). Other complimentary technologies are rainwater harvesting, improved sanitation, solar lighting and energy savings cooking stoves.

The dissemination strategy is first to build a demo house with either SSB and SCB in identified strategic locations accessible to FSAs members. The construction sites can either be the FSAs current offices or selected/identified public place. While both SSB and SCB are comparable in cost, the decision on which technology is most suitable will be determined by the location and the homeowner's preference.

The demo house will comprise of:

1. A one room house plus outside pit latrine and bathroom. The design will be subjected to a public review/participation.
2. Attached to the main house will one 5M³ plastic tanks with complete fittings for rainwater harvesting.
3. The 1 room demo house will be fitted with an improved fuel efficient, firewood cooking stove with 2-3 cooking pots capacity.
4. The house will have solar lighting included even though this is not a financial product required, for completeness.

Construction of the demo house - dissemination strategy.

It will be the responsibility of the FSAs management to select and decide where the demo house will be built, in this respect, providing the land/construction site.

Equipment for block making will be the property of the FSAs, which can later be loaned to FSAs members who demonstrates and prove their entrepreneurial capacity to pick up the technologies and run with them commercially, providing the products to aspiring members who are in the process of building their houses.

The construction of the demo house will be used as the training ground and launching pad for future and further rolling out of the technologies. For this to be effective and sustainable, a minimum of 10 local builders and 5 building students from local TVETs will be engaged during the entire blocks production and construction process to completion. A transparent selection criteria



will be developed in ensuring that only the most competent, passionate and with capacity to roll out the technologies will be selected. This is to avoid mistakes made in the past while disseminating new technologies through self-help or social groups, lacking financial or commercial interests, ownership and responsibility. Those selected for training must be local **builders, artisans, building materials manufacturers** and other entrepreneurs who demonstrates and have abilities to run manufacturing and construction using these technologies as a business or commercial enterprise. This is the most sustainable strategy that can guarantee successful dissemination of these technologies.

The first step is to create product awareness brochures and training materials for each FSA. This is estimated at 5 days of the ABMT consultant time.

Then the project can be rolled out in different FSAs, beginning with most suitable ones for the pilot. The activities and cost for this is broken down below. This excludes any cost for the FSA staff, shareholder training baraza cost etc. It is limited to the cost of the ABMT consultant and his assistants, plus all cost of training including equipment, transport, daily payments to the 15 artisans being trained to compensate them for wages lost etc.

Indicative Budget per FSA : Table 1

Estimated Cost Per FSA Cost							
No	Item	Unit	Qty	Rate in Ksh	Fees KShs	Pyts to artisans, transport for training	Equipment, Materials KShs
1	FSA Staff & Artisans Awareness Training (<i>Senior trainer and Assistant Trainers</i>). 6 days in each FSA	Days	6	60,000	360,000		
2	Phase 1 Artisan Training in each FSA - 10 days training	Budget	1	954,000	720,000	234,000	
3	Phase 2 Artisan Training in each FSA - 21 days training	Budget	1	1,323,000	990,000	333,000	
4	Complete Demo Houses 4Mx4M (16SM) (SCB or SSB) in each FSA - materials only as artisans being trained will provide labour	Item	1	250,000			250,000
5	Demonstration Pit latrine & Bathroom in each FSA	Item	1	60,000			60,000
6	Demo Rainwater harversting (5,000 Litres Plastic Tanks)- gutters in Demo Hous	Tanks	1	45,000			45,000
7	Solar Lighting x 2	Item	1	20,000			20,000
8	Improved Firewood Cooking Stoves x 2	Item	1	15,000			15,000
9	SCB & SSB Block Making Equipment & Construction Tools x 2	Item	1	255,700			255,700
	Sub-total				2,070,000	567,000	645,700
	Total Cost per FSA						3,282,700

Budget Notes:

1. The demo house budget is for a complete 1-roomed house with a floor area of 16M².
2. Pit latrine budget is as per BOQ, including pit excavation.
3. One x 5,000 litres water tanks complete with water collection gutters has been provided.
4. Solar lighting will be provided for completeness although this is well adopted.
5. Phase 1 training which will take 10days including production of blocks required for construction and simultaneously built the demo house foundations to floor slab.
6. Phase 2 training will take 21 days that will see the complete construction of the house.
7. The total trainees' beneficiaries are 15. 10 will be selected local builders and 5 will be students from local TVETs. During the training, they will be paid an allowance equivalent to local builder's wages.
8. There will be a Senior Trainer/Coordinator/Manager overseeing the training, supported by 2 of his assistants. As the pilot is rolled out to more FSAs the training assistant can take over more responsibilities from the senior trainer.










Annex 1: Complete rainwater harvesting packages

For effective rain water harvesting, FSA should consider giving loans for water harvesting packages backed up with technical support in form of installation in ensuring that every drop of rainwater is harvested from the roofs and collected in the tanks.

The homeowners should apply for a complete water tank loan package comprising of the tank, fascia board and gutters for collecting the rainwater and directing it to the tank.

The table below illustrates ideal rainwater harvesting packages, designed in relation to the water tanks capacities.



Item	10,000 Litres	5,000 Litres	3,000 Litres	2,000Litres	1,000 Litres
 Plastic Tank	1 tank 75,000/-	1 tank 40,000/-	1 tank 25,000/-	1 tank 18,000/-	1 tank 12,500/-
 8"x1" Fascia Board	24 Metres 8,400/-	12 Metres 4,200/-	12 Metres 4,200/-	8 Metres 2,800/-	8 Metres 2,800/-
 Gutters x 5M	5 Gutters 8,500/-	3 Gutters 5,100/-	3 Gutters 5,100/-	2 Gutters 3,400/-	2 Gutters 3,400/-
 Stop End	2 pieces 500/-	2 pieces 500/-	1 Pieces 250/-	1 Piece 250/-	1 Piece 250/-
 Corner Gutter	4 pieces 1,000/-	2 Pieces 500/-	1 Piece 250/-	0	0
 Outlet	2 pieces 500/-	1 Piece 250/-	1 Piece 250/-	1 Piece 250/-	1 Piece 250/-
 3" Diameter Down Pipe	1 pipe 900/-	1 Piece 900/-	1 Piece 900/-	1 Piece 900/-	1 Piece 900/-
 3" Diameter Elbow	2 Pieces 300/-	1 Piece 150/-	1 Piece 150/-	1 Piece 150/-	1 Piece 150/-
 Gutter Brackets	15 brackets 1,250/-	10 brackets 1,500/-	10 brackets 1,500/-	6 brackets 900/-	6 brackets 900/-
½" Nails	1Kg 200/-	1Kg 200/-	1Kg 200	1Kg 200/-	1Kg 200/-
Concrete Base	3M x 3M 27,000/-	2.5M x 2.5M 18,000/-	2.5M x 2.5M 18,000/-	2M x 2M 12,000/-	2M x 2M 12,000/-
Estimated Labour Cost	7,500/-	7,500/-	6,000/-	6,000/-	4,500/-
Total Package Cost	131,050/-	78,800/-	62,050/-	45,350/-	38,350/-

Footnote:

1. The prices used are an average cost over the 5FSAs visited and the actual price will vary especially for the tanks depending on the manufacturer.
2. Concrete base cost will vary depending on materials used. The above estimate is either using stones/bricks for walls and a 10cm thick concrete
3. Estimated labour cost is for fixing fascia board & gutters.

Annex 2: Complete 3 room and 1 room house with SSB in Kakeani and Kathonzweni

The Foundation is a strip foundation 150 mm thick (1:3:6). The floor and perimeter concrete edge are 0.1m concrete slab finished smooth. The roof is a hipped roof with G30 Corrugated Iron sheets. SSB are 290x 140x120mm plastered internally and joints pointed externally.



Bill of Quantities for a 3-Roomed House and 1 room - Kathonzweni and Kakeani using SSB										
		3 room house 48sqm				1 room house 16sqm			1 rm/3rm	
No	Item	Unit	Qty	Rate in Ksh	Cost	Sub-Totals	Qty	Cost/Room	Sub-Totals	
A Foundation Strip & Walls										
1	Cement	50Kg Bag	15	800	12,000		7	5,600		
2	Sand	Tons	3	1,200	3,600		2	2,400		
3	Gravel	Tons	4	2,600	10,400		2	5,200		
4	SCB	Nos	350	45	15,750		200	9,000		
	Sub-Total				-	41,750	-	-	22,200	53%
B Floor slab & Perimeter Concrete Edge										
1	150mm thick Hardcore	Tons	5	1,200	6,000		2	2,400		
2	Cement	50Kg Bag	25	800	20,000		10	8,000		
3	Sand	Tons	5	1,200	6,000		2	2,400		
4	Gravel	Tons	9	2,600	23,400		4	10,400		
5	DPM	SM	50	200	10,000		25	5,000		
	Sub-Total				-	65,400	-	-	28,200	43%
C Walls										
1	Cement	50Kg Bag	14	800	11,200		5	4,000		
2	Sand	Tons	4	1,200	4,800		2	2,400		
3	Stabilized Soil Blocks	Nos	3000	25	75,000		1,200	30,000		
	Sub-Total				-	91,000	-	-	36,400	40%
D Ring Beam (150x150mm)										
1	Cement	50Kg Bag	4	800	3,200		3	2,400		
2	Sand	Tons	0.5	1,200	600		0.50	600		
3	Gravel	Tons	1	2,600	2,600		1	2,600		
4	D-12	Nos	12	1,680	20,160		6	10,080		
5	D-6	Nos	8	350	2,800		4	1,400		
6	Binding wire	Kgs	5	250	1,250		3	750		
7	Formwork provision	Item	1	10,000	10,000		1	5,000		
	Sub-Total				-	40,610	-	-	22,830	56%
E Plastering & Pointing										
1	Cement	50Kg Bag	12	800	9,600		7	5,600		
2	Sand	Tons	3	1,200	3,600		2	2,400		
	Sub-Total				-	13,200	-	-	8,000	61%
F Windows										
1	1.2M x 1.2M	Nos	4	10,000	40,000		2	20,000		
	Sub-Total				-	40,000	-	-	20,000	50%
G Doors										
1	External Metal door (2.2Mx0.9M)	Nos	1	20,000	20,000		1	20,000		
2	Internal Flash Doors	Nos	2	10,000	20,000		-	-		
	Sub-Total				-	40,000	-	-	20,000	50%
H Roof										
1	100x50mm Timber	LM	220	160	35,200		90	14,400		
2	75x50mm Timber	LM	100	120	12,000		70	8,400		
3	200x25mm Fascia Board	LM	40	225	9,000		20	4,500		
4	G30 2.5 CIS	Nos	42	1,300	54,600		18	23,400		
5	Hoop iron	Roll	1	4,500	4,500		1	4,500		
6	Ridge Caps	Nos	25	350	8,750		9	3,150		
7	Assorted wire nails	Kgs	20	250	5,000		7	1,750		
8	Roofing nails	Kgs	6	300	1,800		3	900		
	Sub-Total				-	130,850	-	-	61,000	47%
I Rain water Harvesting										
1	5M - Gutters	Nos	8	1,500	12,000		5	7,500		
2	Corner gutters	Nos	6	500	3,000		4	2,000		
3	Outlets	Nos	2	500	1,000		1	500		
4	Gutter Brackets	Nos	32	150	4,800		18	2,700		
5	Screws	Pks	1	500	500		1	500		
	Sub-Total				-	21,300	-	-	13,200	62%
Totals					484,110			231,830		
Labour @35%					169,439			81,141		
Grand Total					653,549			312,971	48%	
Cost per SQM =					13,616			19,561		

Annex 3: Complete 3 room and 1 room house with SCB in Kakeani and Kathonzweni

The Foundation is a strip foundation 150 mm thick (1:3:6). The floor and perimeter concrete edge are 0.1m concrete slab finished smooth. The roof is a hipped roof with G30 Corrugated Iron sheets. SCB are 390 x 150 x 200 m, plastered internally and joints pointed externally.



Bill of Quantities for a 3-Roomed House and 1 room - Kathonzweni and Kakeani using SCB										
No	Item	3 room house 48sqm					1 room house 16sqm			1rm/3rm
		Unit	Quantity	Rate in Ksh	Cost	Sub-Totals	Qty	Cost/Room	Sub-Totals	
A Foundation Strip & Walls										
1	Cement	50Kg Bag	15	800	12,000		7	5,600		
2	Sand	Tons	3	1,200	3,600		2	2,400		
3	Gravel	Tons	4	2,600	10,400		2	5,200		
4	SCB	Nos	350	45	15,750		200	9,000		
	Sub-Total				-	41,750	-	-	22,200	53%
B Floor slab & Perimeter Concrete Edge										
1	150mm thick Hardcore	Tons	5	1,200	6,000		2	2,400		
2	Cement	50Kg Bag	25	800	20,000		10	8,000		
3	Sand	Tons	5	1,200	6,000		2	2,400		
4	Gravel	Tons	9	2,600	23,400		4	10,400		
5	DPM	SM	50	200	10,000		25	5,000		
	Sub-Total				-	65,400	-	-	28,200	43%
C Walls										
1	Cement	50Kg Bag	14	800	11,200		5	4,000		
2	Sand	Tons	4	1,200	4,800		2	2,400		
3	SCB	Nos	1200	45	54,000		500	22,500		
	Sub-Total				-	70,000	-	-	28,900	41%
D Ring Beam (150x150mm)										
1	Cement	50Kg Bag	4	800	3,200		3	2,400		
2	Sand	Tons	0.5	1,200	600		0.50	600		
3	Gravel	Tons	1	2,600	2,600		1	2,600		
4	D-12	Nos	12	1,680	20,160		6	10,080		
5	D-6	Nos	8	350	2,800		4	1,400		
6	Binding wire	Kgs	5	250	1,250		3	750		
7	Formwork provision	Item	1	10,000	10,000		1	5,000		
	Sub-Total				-	40,610	-	-	22,830	56%
E Plastering & Pointing										
1	Cement	50Kg Bag	12	800	9,600		7	5,600		
2	Sand	Tons	3	1,200	3,600		2	2,400		
	Sub-Total				-	13,200	-	-	8,000	61%
F Windows										
1	1.2M x 1.2M	Nos	4	10,000	40,000		2	20,000		
	Sub-Total				-	40,000	-	-	20,000	50%
G Doors										
1	External Metal door (2.2Mx0.9M)	Nos	1	20,000	20,000		1	20,000		
2	Internal Flash Doors	Nos	2	10,000	20,000		-	-		
	Sub-Total				-	40,000	-	-	20,000	50%
H Roof										
1	100x50mm Timber	LM	220	160	35,200		90	14,400		
2	75x50mm Timber	LM	100	120	12,000		70	8,400		
3	200x25mm Fascia Board	LM	40	225	9,000		20	4,500		
4	G30 2.5 CIS	Nos	42	1,300	54,600		18	23,400		
5	Hoop iron	Roll	1	4,500	4,500		1	4,500		
6	Ridge Caps	Nos	25	350	8,750		9	3,150		
7	Assorted wire nails	Kgs	20	250	5,000		7	1,750		
8	Roofing nails	Kgs	6	300	1,800		3	900		
	Sub-Total				-	130,850	-	-	61,000	47%
I Rain water Harvesting										
1	5M - Gutters	Nos	8	1,500	12,000		5	7,500		
2	Corner gutters	Nos	6	500	3,000		4	2,000		
3	Outlets	Nos	2	500	1,000		1	500		
4	Gutter Brackets	Nos	32	150	4,800		18	2,700		
5	Screws	Pks	1	500	500		1	500		
	Sub-Total				-	21,300	-	-	13,200	62%
	Totals				463,110		-	224,330		
	Labour @35%				162,089		-	78,516		
	Grand Total				625,199		-	302,846	48%	
	Cost per SQM for 3-Rooms =					Cost per SQM for 1-Room		18,928		

A ceiling can be added as an option at the following cost for all the various house typologies

Ceiling Option/Per Room 16sqm				
50x50mm Ceiling Blundering	LM	30	80	2,400
Cornice 100x25mm	LM	20	160	3,200
9mm plywood	Nos	6	1,500	9,000
Ceiling nails	Kgs	2	250	500
Totals				15,100

Annex 4: Improved pit latrine and bathroom BOQ – 2m x 2m

The proposed improved pit latrine has a concrete floor slab and an adjacent bathroom both with a floor area of 4M².

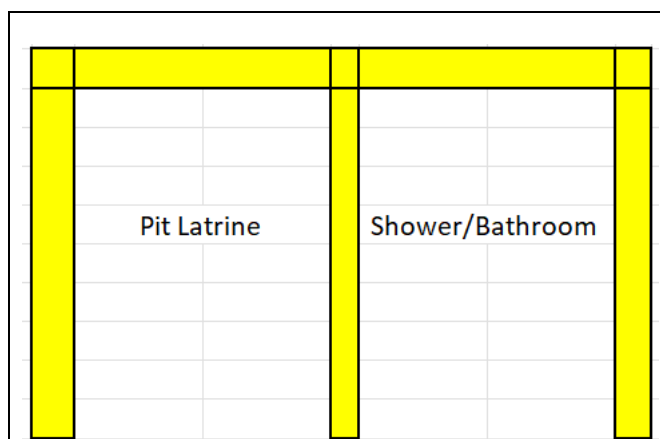
Each unit is 2M long x 1M wide. Three technologies options have been used. Poles/timber and IR (iron sheets) super structure, SSB (Stabilized Soil Blocks) and SCB (Sand Cement Blocks super structure). The last 2 columns show the costs using SSB and SCB.

No	Item	Poles & Ironsheets	SSB	SCB
1	Pit Excavation	12,000	12,000	12,000
2	Concrete Slab	7,810	12,010	12,010
3	Walls & Roof	24,530	21,100	21,100
4	Labour	15,519	16,051	15,789
	Totals	59,859	61,161	60,899
	Ranking	1	3	2

(Refer to tab 'Pit Latrine Comparisons' in attached excel.

Footnotes:

1. The BOQ is specifically for the concrete slab and superstructure.
2. The pit latrine hole should be L1.4M x W0.7M. The depth should be as deep as possible but not less than 10M.
3. In some sandy soil grounds, the pits will require lining with concrete blocks or stones.



Layout Plan for Pit Latrine & Shower Room 2M x 2M





Green Suites Palm Suite,
Riverside, Riverside Drive
P.O. Box 11353, 00100
Nairobi, Kenya

www.fsdkenya.org